Engineering Specification
Signals
Construction

SPG 0714

COMPRESSED AIR SYSTEMS

Version 3.0

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Engineering Specification

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Document control

Version	Date	Summary of change
1.0	26 February 2008	SPG 0714 replaced SC 09 20 00 00 SP v2.0 of November 2001.
2.0	10 September 2008	Minor updates from recent works. Changed: 1.1, 1.2, 2.2, 4.1, 4.5, 5.4, 5.6, 6.1, 6.3, 6.5, 6.6, added 7.1.3, Appendix 2 – deleted SPG0714 added M11-321 & Appendix 3 deleted DS-P-001, amend data sheet.
2.1	21 November 2008	Update to sect 5.6 Flexible Hose. New sect 5.8 Orifice Plates added.
2.2	3 February 2009	Section 3 – new text added. New subsection 3.3 'Equipment Parameters' added at request of Chief Engineer Signals.
2.3	19 January 2010	Air Compressor Data Sheet in Appendix 3 – 'preferred' added after Power Supply details.
2.4	7 May 2010	Delete references to 'variable speed drives' in Section 4.1 and Air Compressor data sheet and application of TMA 400 format.
2.5	9 September 2011	'NSW Transport RailCorp' logo applied. Text added to sect 6.2.4 third paragraph "except where the pipe run is….". Miscellaneous spelling and grammar corrections.
2.6	6 December 2011	Amendments with respect to electrical insulation of pipework in 5.4; Section 4 – delete reference to Appendix C; Section 6.2.4 – amended formatting with respect to pipe anchoring. Section 5.9 – Valves – New section
2.7	7 March 2012	New sections 4.6 Pressure Containment Valves & 4.7 Local Reservoirs.
2.8	3 April 2012	1.2 & 4.1 - add reference to SPG 1870 4.1 -added 'where necessary' after 'cooler' at end of sentence. 6.1 - add provision for adequate clean air intakes
2.9	4 September 2012	5.6 – add Class type to AS2554 & 2660; all hoses to be subject to approval; delete reference to Alphagomma type hoses; Appendix C – delete reference to SPG 1837 Amended sections 6.6, 7.1.1, and Appendix B added drawing M11-701.
3.0	18 March 2013	Replace reference to drawings with a SPG0714 prefix with those having a M11 prefix; 4.1 – add note that compressors are to be connected with flexible hoses; 5.2 – add note that pipework are to be accessible 5.5 – added "or RHS tube" 5.6 – added "Where stainless steel hoses are used they shall be insulated at the connection to the manifold ball valve….."

Summary of changes from previous version

Summary of change	Section
Delete reference to drawings with SPG0714 prefix and replace with M11 prefix drawings;	1.2 & App B, App C
4,1 – Compressors – add sentence concerning connection of compressors	4.1
5.2 – Add paragraph – re access to pipework	5.2
Delete references of drawing numbers with SPG0714 prefix and replace with M11 prefix	5.3,

drawings	6.2.4
5.5 – Add text.	5.5
5.6 – Add paragraph.	5.6
Drawings M11-349-1 and M11-349-2 updated to revision 'B'	App B

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1 Scope

1.1 Introduction

This specification details the design, fabrication, installation, testing and commissioning of compressed air systems for railway signalling use, and is to be used for both new and altered systems. The compressed air system includes, but is not limited to, air Compressor Rooms (consisting of air compressors, dryers, and controls), air receivers, pipe-work and associated piping components such as manifolds and valves. The compressed air systems will be used to operate track turnouts (points) and train stops, both of which are actuated by pneumatic cylinders.

1.2 Reference Documents, Standards and Codes

The following reference documents form part of this specification.

M11-349-1 & 2 *Standard Air System Drawing Symbols for Air Systems*
M11-351-1 & 2 *Compressed Air Piping Arrangement*
M11-350 *Connection Single Trainstop to Main*
M11-352 *Anchor Points*
M11-353 *Steel Air Main Bracket*
M11-355 *Label Holder Installation, Part: Carrington Tang Clamp, 1/2" and ¾"*
M11-354 *Label Holder Installation Example on General Manifold Arrangement*
SPG 1870 Air Compressors for Signalling Systems

M11-307 *Air Hose, P.V.C. detail of Fittings*
Drawings produced from design phase
DS-P-001 *GMS01 Piping*
DS-P-002 *MS01 Piping*
DS-P-003 *SS01 Piping*
DS-P-004 *Halogen Free Flexible Piping*
DS-EQ-001 *Air Compressor*
DS-EQ-002 *Compressed Air Dryer*
DS-EQ-003 *Air Receiver*
SPG 0705 *Construction of Cable Route and Associated Civil works*
ESG 100.25 *Compressed Air Systems*
SPG 0703 *Signalling Documentation and Drawings*

The following Australian Standards and statutory codes form part of this specification.

AS 1074 *Steel Tubes and Tubulars for Ordinary Service*
AS 1210 *Pressure Vessels*
AS 1345 *Identification of the Contents of Piping, Conduits and Ducts*
AS/NZS 1477 *PVC Pipes and Fittings For Pressure Applications*
AS/NZS 1518 *External Extruded High-density Polyethylene Coating System for Pipes*
AS 2129 *Flanges for Pipes, Valves and Fittings*
AS/NZS 2554 *Hose and Hose Assemblies for Air*
AS 2660 *Hose and Hose Assemblies – Air/water – For Underground Coal Mines*
AS 4041 *Pressure Piping*
AS/NZS 4680 *Hot-dip Galvanized (Zinc) Coatings on Fabricated Ferrous Articles*

AS/NZS 4792 *Hot-dip Galvanized (Zinc) Coatings on Ferrous Hollow Sections, Applied by a Continuous or a Specialized Process*

NSW Work, Health and Safety Act 2010.

NSW Work, Health and Safety Regulations 2011

Rail Safety Act *2002*

1.3 Installer Supplied Data

Refer to Appendix A for Installer supplied data.

2 Design

2.1 Design Inputs

The following data shall form part of the design inputs, along with other data listed in the Particular Specification (eg scope of work) and RailCorp Design Principles document:

Reference documents, standards and codes (refer Section 1.2);

Available information on the existing air reticulation system and pneumatic signalling equipment in the project area to which the new work is to be connected; and/or plans showing the proposed location of the new pneumatic signalling equipment;

Available information on the location of existing cable routes and any existing air reticulation system which is to be replaced by the new work;

Available information on the current noise, air and waste emission approval limits, including any information on any new limits which may apply to the works;

Fluid parameters (refer Section 3.1);

Environmental and site factors (refer Section 3.2);

Operating and control philosophy (refer to document ESG 100.25);

Design life of 25 years for equipment, and 50 years for pipework and structures;

Maximum thermal expansion of -10 °C to 60 °C, and maximum thermal movement of a manifold or cross tie branch to be +/- 25 mm;

The equipment and pipe work shall be designed and installed to provide maximum protection and safety for operating and maintenance personnel. Safety equipment shall include guards, access covers, inspection covers, emergency stop equipment, safety interlocks, and other devices required by the statutory authorities;

The pipework shall be designed to ensure all manually operated valves are in positions where the valve hand wheel can be comfortably reached and operated from an access platform, floor, walkway or stairway; and

Permanent lifting devices to be provided for operation and maintenance personnel, such that maximum manual lift weight is 16 kg. This limit may be lowered further in specific instances, based on the outcomes of a risk assessment (refer WH&S Act 2010).

All equipment proposed for the air system shall require type approval.

2.2 Design Documentation

The following design documentation shall be generated, as a minimum, during the design process:

Process flow diagram, mass balance, and/or network hydraulic model, to document the capacity of the extended/new system;

Equipment, piping and instrument data sheets in sufficient detail to allow procurement of these items;

General arrangement, layout and detail drawings of the Compressor Room equipment and instrument installation;

Electrical power and control details, including protection scheme and interface list;

Schematic books, similar to current books, detailing the new pipework involved, connections to existing pipework, and corrections to existing schematics;

Specifications to cover fabrication, installation, and commissioning requirements; and

Functional description in sufficient detail to allow software coding to proceed.

Maintain VDU + Compressor PLC system design user manual, including all software & licences.

3 Fluid Parameters, Site Details and Equipment Parameters

3.1 Fluid Parameters

Fluid parameters are:

Fluid is compressed air to quality class 2.4.2 of ISO 8573, downstream of dryer post-filter;

Temperature range 10ºC to 50ºC between compressors and receivers; and

Temperature range -10ºC to + 60ºC downstream of receiver.

3.2 Environmental and Site Factors

Environmental and site factors are:

- Location is the Railcorp region within NSW;
- Ambient temperature range –10 to +60ºC;
- Rainfall range 600 mm to 2000 mm per annum;
- Humidity range 40% RH to 100% RH;
- Ground conditions may include induced currents from rail power supply;
- Potential close proximity to noise sensitive areas; and
- Other environmental factors are vibration (from rail traffic) and mechanical damage (impacts from ballast during rail maintenance).

3.3 Equipment Parameters

3.3.1 Points

An EP points motor with 125 mm bore and 180 mm stroke has a volumetric capacity of 0.0022 cu M.

3.3.2 Train Stops

An electro-pneumatic trainstop having cylinder dimensions of 76 mm bore & 70 mm stroke has a volumetric capacity of 0.0003175 cu M.

4 Equipment Supply

4.1 Compressors

Compressors shall be in accordance with SPG 1870 complete with integral oil separator and after cooler where necessary. The minimum size shall be 10 Litres/Second capacity. Units shall be delivered, handled and stored in a manner which maintains the “new” condition of the units.

Compressors shall be connected to the fixed pipework by flexible stainless steel hoses.

4.2 Receivers

Receivers shall be horizontal or vertical cylindrical pressure vessels of carbon steel welded construction in accordance with AS 1210. Integration of the receiver into the compressor skid should be considered for smaller systems. Units shall be delivered, handled and stored in a manner which maintains the “new” condition of the units.

4.3 Dryers

Dryers shall be refrigerated type units. Units shall be delivered, handled and stored in a manner which maintains the “new” condition of the units.

4.4 Expansion Joints

Expansion joints shall be externally pressurised bellows type units, complete with drain port. Bellows shall be stainless steel, and other components shall be carbon steel. Flanges shall be AS 2129 Table E. Joints shall be designed and manufactured in accordance with Expansion Joint Manufacturers Association recommendations. An anchor point is to be provided mid point between expansion joints.

4.5 Miscellaneous Equipment

Miscellaneous equipment will be as follows:

All air filters shall be fitted with differential pressure (dp) valves;

Lifting devices for compressors shall be monorails or gantry cranes, complete with wire rope hoist, electric raise/lower, electric travel and pendant control;

4.6 Pressure Containment Valves

Each trainstop and manifold shall be fed through a non-return valve located after the main shut off valve. This valve is to prevent loss of air from the equipment in the event of an air main failure.

The pressure containment valve shall be of stainless steel construction with either metal-metal or metal/Teflon seats.

These valves shall be maintenance-free.

4.7 Local Reservoirs

Local reservoirs shall be provided when required to even out airflow demand and to backup the air supply pressure where a number of equipment items are fed from the one manifold.

The local reservoir shall be of stainless steel construction with the air connection at the low point, small diameter and vertically mounted. They may require Workcover design registration, but not require any other ongoing registration or maintenance other than inspection. The units shall not exceed a PV of 100 MPaL, based on a design pressure of 720 kpa (approximately 135 L capacity maximum – Hazard Level D to AS4343).

If the design requires, more than one unit may be installed to provide a greater capacity. Usually they shall be installed at manifolds.

A point orifice plate shall be fitted at the manifold if connected via a PVC hose.

5 Pipework

5.1 Piping Classes

Piping classes are listed in the piping data sheets (refer Appendix C), and contain details of design pressures, temperatures, materials etc. All pipework shall be selected from these piping classes only, and shall comply with AS 4041.

5.2 Pipework Arrangement

Pipework design principles are shown in the reference drawings (refer Appendix B). These demonstrate preferred methods for manifolds, branches, drains, etc and shall be adhered to in the design of the new work.

Underground cross ties shall be flexible hose within PVC pressure pipe conduit or galvanised steel pipe with 450g/m^2 coating. No joints shall be allowed in flexible hose.

A cross tie using flexible hose may be installed in a single conduit with up to two large radius bends at each end to avoid the need for a pit.

Pipework shall be designed to ensure that there is sufficient flexibility to absorb any expansion or contraction, without excessive stresses or loads on equipment, or cause leakage at joints. Expansion joints, expansion loops, anchor points, pipe bends and other items as necessary shall be considered for this purpose.

Compressed air lines shall slope downward in direction of flow, at 1:200. Condensate trap points shall be placed at the bottom of vertical risers. Inline drainage trap points for compressed air shall consist of a tee, drop leg, ball valve and auto drain. Waste water lines shall slope downward in direction of flow, at 1:40. Notwithstanding this valves and equipment shall not be located in pits. Valving arrangements shall facilitate the blowing out of water that may accumulate in low sections.

Except at anchor points, the brackets supporting the main shall allow axial freedom for expansion and contraction but shall not permit vertical or lateral movement exceeding 5mm (2mm either side of expansion joints).

The bracket shall be manufactured from hot dip galvanised steel except in tunnels where it shall be manufactured from stainless steel.

All pipework shall be easily accessible. Where pipe connections are unavoidably elevated, a union shall be provided at an accessible position to permit work on the piping without the necessity to access the elevated portions.

5.3 Steel Piping

The compressed air lines shall generally be constructed from galvanised carbon steel pipe, or stainless steel pipe.

For carbon steel lines, joints shall generally be screwed or flanged, as required. Welding procedures to be used by the Installer shall be submitted for approval before commencing work. These shall include weld repair procedures. Welded pipe spools are to be hot dipped galvanised after fabrication.

For stainless steel lines, joints shall generally be screwed, welded or flanged. Weld filler metal shall have corrosion resistant properties similar to or better than the base metal. The welding procedure followed shall preserve corrosion resistance in the weld and heat affected zone to maintain optimum mechanical properties in the joint and minimise heat distortion. Fabrication shall be carried out with equipment made from stainless steel, free from contaminants and which has not previously been used on carbon steel or non ferrous material. Joint cleaning shall not use chlorinated solvent.

All joints shall be aligned with mechanical devices and shall be free of depressions and bumps. Heat shall not be used to obtain alignment.

Steel air mains must never be attached to overhead wiring structures or signal gantries (Except for cross ties addressed in Section 5.4). A minimum clearance of 75mm must be maintained between the air line and overhead wiring structure or signal gantry.

Wherever practical steel air main should be placed two metres from any overhead wiring structure or signal gantry.

5.4 Insulation Joints

Insulation joints shall be rated for 2500V AC for one second.

Insulation joints shall be installed in the following locations:

- Between the main and the Compressor Room;
- Where the main enters or leaves the ground or a pit;
- Within 1 m of each end of any steel bridge;
- Every 500 m in the steel mains; and
- Coincident with steel troughing insulated joints, where both pipe and troughing utilise the same support.

At least two insulated joints shall be provided between any two signalling locations.

Where the air line is within 2 m of an overhead wiring structure that is not fitted with a spark gap, the line is to be covered with an insulating sleeve (eg class 12 PVC pipe) for a distance of 2 m either side of the structure. Suitable clamps or clips are to be provided to prevent movement.

Where steel pipe is used for an overhead cross tie, it must be separated from the steel main by at least 2.0 metres of flexible PVC air hose.

Insulated joints shall not be located where they could be bypassed by a metal structure (e.g. a metal bridge).

5.5 Manifolds

Manifolds shall be constructed from stainless steel pipe or stainless steel RHS tube, and comply with the requirements of the drawings listed in Appendix B.

Manifolds shall be placed adjacent to the equipment to which they are to be connected. Where it is physically impossible to place a manifold within 75 metres from the equipment it supplies the installer must seek additional approval.

Take offs from the main air lines shall preferably be vertically upwards. Where the manifolds are to be located below the main air line a low point & drain shall be provided below the take off points.

5.6 Flexible Hose

All polymeric hoses not in tunnels shall be fabricated in accordance with AS/NZS 2554 Class B. All polymeric hoses in tunnels shall generally be in accordance with AS 2660 Class A, and must be 'low smoke halogen free' as required by cable specification RHG-3 of AS 4507. All hoses are to be subject to approval. Stainless steel hoses shall be fabricated in accordance with relevant ISO standards, and to be an approved type.

Flexible hose shall always be used for the connection between manifold and pneumatic equipment. All flexible air hoses shall be protected from sunlight by conduit. Hose connections to equipment within five metres of a manifold shall be run on the surface within a flexible orange coloured PVC conduit. If the equipment is more than five metres from the manifold, the hose and conduit shall be buried as per SPG 0705 "Construction of Cable Route and Associated Civil Works". The flexible conduit is to be carried to within 100mm of the connection at each end of the hose whether buried or surface run.

Where stainless steel hoses are used, they shall be insulated at the connection to the manifold ball valve. Stainless steel hoses that run beneath the rails shall be enclosed in flexible orange coloured PVC conduit.

Where flexible air hose is used for the main air line, it shall be installed in a properly constructed cable route in accordance with SPG 0705.

Tails for flexible hoses shall be:

- For hoses less then 18 mm Nominal Bore (NB) a single non-serrated bulb tail with one single stainless steel Bandit Clamp or approved equivalent.
- For hoses 18 mm NB or greater a double non-serrated bulb tail with two stainless steel Bandit Clamp or approved equivalent.

Tails shall be of a type that does not damage the hose. Tail size shall be specifically assessed as the correct size for the hose type. Specifically the end of the tail shall be smooth and rounded to prevent damage to the pipe when flexed.

Bandit type clamps or approved equivalent shall only be applied using an approved tool which applies a pre set consistent application pressure. Clamps shall apply an even pressure around the entire circumference of the hose.

The female union nut shall be capable of rotating without twisting the hose.

Where a main flexible air hose is to be bent through a radius less than the manufacturers recommended minimum radius, a stainless steel elbow shall be installed.

Flexible hoses shall not be bent within a distance of (5 x Hose Outside Diameter) to the tail. Additional hose supports / clamps shall be provided where necessary to achieve this.

Flexible air hoses shall be buried in a separate conduit, in buried cable routes.

In GST and GLT installations the air hose must be laid on top of all cables to avoid compression of the air line.

The ends of all flexible air hoses shall be sealed during installation to prevent the ingress of dirt or water.

5.7 Identification and Painting

Individual pipework items such as valves, manifolds, instruments, and expansion joints shall be fitted with permanent labels. The label shall be made of stainless steel, and fixed to the equipment using split rings or screws. Characters shall be a minimum of 4 mm high. Identification label inscriptions shall include the following information:

Valve/manifold/instrument/joint code (up to 8 characters);

Manufacturer's model number and size; and

Design rating.

Valve codes shall be as follows:

Air user control valves – ‘SY 456S TS’, ‘333 PTS’;

Stop valves on mains, cross ties, manifolds etc – ‘N.O.’ or ‘N.C.’;

Stop valves on sub-main feeds – ‘Sub-main 111 PTS, 113 PTS, 444 TS’; and

Stop valves on outlet of receivers/compressors feeding certain areas – ‘Down Main West’;

Manifold codes shall be determined during the design phase, in consultation with the Asset Owner and Asset Maintainer.

All pipeline contents shall be identified by self adhesive labels, in accordance with the methods given in AS 1345. The direction of flow shall be suitably indicated at each label. When the pipe size is very small, the strip is to be affixed by a suitable flag off the pipe in accordance with the standard. The following method of colour coding is to be used:

An identifying strip is to be fixed to the pipe at the intervals recommended by the standard. The identifying strip is to have coloured lettering on a white background. The coloured lettering is to be in accordance with the pipeline colour as shown in Table 1 below;

The arrow indicating the direction of flow shall be the same colour as the lettering on the identifying strip; and

Where necessary, warning flags are to be located at the ends of the identifying strip in accordance with the standard.

Pipe Contents	Colour (to AS 2700 u.n.o.)
Compressed Air	B25 Aqua
Waste Water	Black

Table 1 - Pipe Colours

Letters shall be as follows:

- 25 mm Letters up to DN 80

- 50 mm Letters above DN 80

The location of identification labels shall be at intervals of not more than 8 m, adjacent to changes in direction, branches, junctions, valves, wall penetrations and control points. Labels shall be placed so that they are easily seen. Uninterrupted lengths of external services, visible along their length, shall have labels at 50 m maximum intervals.

Manifold label holders shall be constructed from stainless steel, and incorporate traffolyte labels for manifold, valves, etc. The label holder installation shall be as shown in attached drawings M11-355 and M11-354.

Protective coatings are required for all ferrous pipework, pipe supports, and miscellaneous items. Equipment (compressors, dryers, receivers) will be supplied painted, in accordance with the manufacturers recommendations. Protective coatings shall be hot dipped galvanising to AS/NZS 4680 with 450g/m^2 coating, unless noted otherwise. Damaged sections of galvanising shall be repaired in accordance with Galvanizers Association recommendations.

5.8 Orifice Plates

Orifice plates shall be of nylon not less than 3.0 mm thick and shall be provided to protect against failure of flexible hoses.

Orifice sizes shall be:

- 1.6 mm for trainstops
- 3.2 mm for points

Unless approved otherwise and shall be installed at manifolds. Orifice plates sizes in flexible mains hoses shall be determined in the design.

Orifice plates shall be securely installed between the flat faces of the nipples where inserted into the ball valves.

5.9 Valves

Valves shall be full bore stainless steel, Teflon seat ball valve type to AS4796 with the following characteristics:

- Full bore ball valve.
- Two piece body construction (small valves threaded together and larger valves greater than 50mm bolted together) which allows for the replacement of seals.
- Body made from stainless steel Grade 304 (needs to be Grade 316 in areas where high levels of chlorine are present)
- Female threaded connections to AS1722.1 (British Standard Whitworth parallel form).
- 90 degree operation between open and closed positions.
- Whilst handle is attached, it can be locked in open or closed position.

6 Installation

6.1 Equipment / Compressor Room

Equipment shall be installed on foundations or support structures. The Installer is responsible for supply of all materials needed (such as hold down bolts, grout, lubricants, etc) to complete the installation. The Installer shall follow all manufacturers' instructions

for the installation of the equipment and shall recheck all drive alignments prior to testing of the equipment. The Installer shall check the dimensions on site of all interface points.

Where required, the Installer is to assemble equipment on site, in accordance with the manufacturers' instructions.

Compressors shall be installed in their own room, with sufficiently large entrances to permit the equipment to be removed & maintained.

Adequate provision shall be provided for the supply of clean dry air for the compressor intakes in the quantity required to deliver the compressor outputs at their maximum demand.

In particular, humid moist areas shall not be used for drawing air.

Ventilation shall consider noise levels and be arranged so that the building itself reduces any noise in the direction of adjacent houses.

6.2 Pipework Installation

6.2.1 General

All pipework installation and testing shall be in accordance with AS 4041, and shall include jointing, supporting, provision for flexibility, protection and anchoring.

The Installer shall submit tie-in procedures for approval prior to any tie-in work. The procedure shall detail method/direction of system isolation, in situ work and weld procedure, branch isolation, and method of system repressurisation.

Pipeline components must be fitted together in proper alignment and stress free before bolting or welding. Pipelines shall not be forced or sprung into line to be held with welding or bolting, unless cold pull is specified on the drawings.

During erection, all pipes shall be supported and lined up. Gaskets are to be centrally located on flanges, to ensure the gasket does not protrude into the pipe bore. It shall be the Installer's responsibility to allow closing lengths of pipework to be cut to suit site measurements and to make sure flanges are site welded.

The Installer shall ensure that the site run piping is sufficiently flexible to absorb any expansion or contraction without excessive stresses or loads on equipment or cause leakage at joints. The Installer shall install expansion joints, expansion loops, pipe bends and other items as necessary for this purpose.

The Installer shall follow all manufacturers' instructions for the installation of the instrumentation, and is responsible for supply of all materials needed to complete the installation.

All joints shall be sealed with "Loctite Master Pipe Sealant" or approved equivalent, or taped with Teflon thread sealing tape.

Underground air systems shall never be directly buried, but shall be installed as per the requirements of SPG 0705 "Construction of Cable Route and Associated Civil Works".

6.2.2 Access

The Installer shall arrange piping to allow removal of connected or other plant items and access to plant items for maintenance and operating purposes. Where drawings issued for construction show piping and/or fittings interfering with access to or removal of plant

items, then the Installer shall report such interferences to the Asset Owner, who will decide on changes to the pipe routing.

Where the positions are not specified on the drawings or pipelines are site run, the Installer shall locate all manually operated valves in positions where the valve hand wheel can be comfortably reached and operated from an access platform, floor, walkway or stairway. The location of the pipe, valve and valve operator shall not impede accessways.

6.2.3 Storage

Pipe, fittings and valves are to be protected from damage during transport, storage and installation. Pipework spools shall have their ends temporarily plugged or covered after fabrication to prevent ingress of foreign matter during transport and storage.

Pipework items shall be inspected and have all foreign matter removed prior to installation. Items such as valve stems shall be lubricated where necessary prior to installation.

6.2.4 Supports

The Installer shall supply and install all necessary hangers, supports, brackets, anchors, and pipe support structural steelwork. Unless approved otherwise, supports shall be standard proprietary saddles.

Where necessary during erection and testing, the Installer shall provide and install adequate temporary supports to prevent overstressing of pipework or the equipment to which piping is connected.

Unless specified otherwise on the drawings, horizontal piping shall be supported at not more than the maximum spacings shown in AS 4041 except where the pipe run is a main run along the railway corridor where the maximum spacing shall be 3.0 m. Where mounted on GST posts at 2.0 m spacing, the pipe shall be supported at each post. Vertical pipes shall be supported at 2.0 m intervals unless noted otherwise.

Where a valve, line fitting or other item is installed in a pipeline, a support or hanger shall be located as near as practicable and within 0.5 m. Piping shall be supported not more than 0.5 m from any point where the piping changes direction, with the support or hanger located on the section having the longer span.

Pipe support steel posts shall be typically 100 mm x 50 mm x 10 mm channel, galvanised to AS/NZS 4680 with 450g/m^2 coating. Air main brackets should be as per drawings M11-354 and M11-355.

The pipe shall be anchored:

- Every 300 metres on straight runs
- Where the main enters/leaves a pit
- Where a steel branch, sub main, or steel cross tie intersects with the main
- To restrict the movement of any manifold to +/-25mm
- Where there are larger offsets or changes of direction the line shall be anchored in both directions as shown on drawing M11-352

An air main shall be considered to be straight where:

- Its curved to a horizontal or vertical radius greater than 250 metres.
- There are minor offsets of 900 mm maximum around abutments or structures

Use of structures for anchor points shall be subject to approval.

6.3 Cleaning

Prior to cleaning, all inlets to equipment that may get blocked during cleaning shall be protected using removable in-line strainers. These strainers shall be removed upon the completion of cleaning. The Installer must ensure that line mounted items likely to be damaged by the cleaning are removed. The Installer shall supply, install and remove any temporary closures required.

Cleaning shall consist of air blowing the pipework at a sufficient velocity to remove the dirt in the pipe. Such flow shall continue at least 5 minutes and until the pipeline is clean.

Only dry air shall be used for cleaning.

6.4 Safety Equipment

The equipment and pipework shall be designed and installed to provide maximum protection and safety for operating and maintenance personnel. Safety equipment shall include signage, guards, access covers, inspection covers, emergency stop equipment, safety interlocks, and other devices as specified or implied or as required by any Statutory Authority having jurisdiction.

6.5 Drainage & Ventilation

Pits shall be provided with adequate drainage to a waste water system, or other approved discharge points, to continuously remove stormwater and other liquids; and

Compressor Room shall be provided with adequate drainage to a waste water system, or other containment devices, to control contaminants such as oily water; and

Compressor Room shall be provided with adequate ventilation to maintain recommended compressor operating temperatures and room air balance – louvres, ridge vents and other building openings shall utilise acoustic louvres. Other noise attenuation devices shall also be supplied to comply with noise criteria.

EPA approvals shall be obtained for the proposed waste water arrangements.

6.6 Control & Maintainers System

A system to permit the control and remote monitoring of the air system & its performance shall be developed & installed.

This system shall include:

- Analogue display of pressure.
- Visual and audible alarms.
- Schematic diagram VDU display showing all main elements of the system & their status.
- Power supply status.
- Compressor and dryer status and alarms.
- Logging of all events.

The indications shall be available in the compressor room, and at least one remote site through a TCP/IP interface. The system shall be expandable to permit other remote sites to be added.

A non interruptible power supply shall ensure the continued functioning of the control and maintainers system when the power is interrupted or failed.

The design of the system shall fulfil the requirements of Air System Design Principle ESG 100.24.

All sensors proposed shall be submitted for type approval, including a proposed system configuration. Where sensors are located remotely from the compressor room care is to be taken that surge protection is provided and galvanic isolation provided in cable troughs and air lines is not by passed. Where fibre optic is available between locations, it shall be used for the air monitoring in lieu of cables. Copper cabling shall be kept short.

The electrical design of this system shall be documented in the signalling circuit books. Where the equipment and wiring is installed in signalling locations, it shall be physically separate from vital equipment.

All software code, programming manuals, maintenance and user manuals shall be provided, including any necessary licences for the ongoing operation and modification of the system.

7 Testing and Commissioning

7.1 Testing

7.1.1 Mechanical Equipment Testing

No-load testing of rotating equipment shall be carried out in coordination with other Installers. Drives shall be checked for direction of rotation, and then tested for no load running. Testing shall comprise running the equipment to check for smoothness of operation, vibration, overheating, and operation of safety switches, instruments and appurtenances.

7.1.2 Pipework Testing

All pipework shall be pneumatically tested at the test pressures nominated in the pipe data sheets, using dry air.

The Installer must ensure that line mounted items likely to be damaged by the pressure testing are removed. The Installer shall supply, install and remove any temporary closures required.

All flanged or threaded joints, mechanical couplings, field welds, valves and fittings whether above ground or underground, shall be left exposed, with joints unpainted, until testing has been completed to the satisfaction of the Asset Owner.

Drains, vents, safety valve discharges, etc. which are open to atmosphere do not require testing. Such lines shall be checked to ensure all joints are properly made and are tight.

Test pressure shall be applied for at least 20 minutes. If no leakage is observed and the pressure drop is not more than 5% of the test pressure, then the section of pipe will be deemed to have passed the test.

Where leaks are observed or the pressure drops by more than 5% of test pressure, the Installer shall locate and repair any defects and retest the repaired section. The repair procedure is to be approved by Asset Owner prior to performing the repair. The section shall then be retested as above.

When testing is completed, all temporary blanking pieces shall be removed and the pipework drained. Any items removed for testing shall be re-installed and valves closed.

Written records of all tests shall be retained and these and any test certificates shall be forwarded to the Asset Owner and shall in addition be included in the operation and maintenance manuals.

7.1.3 System Testing

A System Testing Plan shall be provided to test that the design concepts have been achieved in the installed system. The Test Plan shall itemise each design criteria and the method of testing for each criteria.

Examples of the testing to be conducted include:

Time to reach working pressure from empty.

Line flow restrictors perform as expected.

All monitoring points are functional.

All compressor on / off controls are proved to function at the correct pressures.

All labelling is correct to design.

All electrical changeovers function as designed

The test plan shall be independently verified and submitted for approval.

Testing shall be conducted in the presence of the asset owner.

The results of all testing shall be recorded and submitted to the asset owner.

Testing shall include all functions remotely monitored by the Maintainers VDU. Where analogue monitoring is provided (such as pressure) the testing shall include calibration & correct correspondence through the pressure range between system limits.

Any tests that failed to meet the design criteria shall have the design reviewed and appropriate corrective action agreed with the asset owner.

7.2 Precommissioning

The Installer shall precommission the equipment in all operation modes.

Precommissioning is the running of the plant and equipment and carrying out all necessary adjustments until it is ready and suitable for normal starting and running under service conditions.

Precommissioning shall be conducted in a logical sequence in accordance with the programme prepared by the Installer and approved by the Asset Owner. The Installer shall prepare schedules and record the results of the tests on the appropriate log sheets.

The Installer shall furnish the Asset Owner with a complete list of control instrument set points and alarm signal settings recommended by the Installer as a result of his precommissioning programme. These recommended settings may be supplied progressively during the precommissioning period but no later than at the end of the period.

7.3 Commissioning

Commissioning is the running of the plant and equipment and carrying out all necessary adjustments until it runs under service condition from part to full load.

Commissioning shall include the tuning of interacting components of control loops to achieve the required control response.

Where equipment items or systems are duplicated in the design to provide “Running” and “Stand-by” facilities, all items of equipment and/or systems of both the “Running” and “Stand-by” facilities shall be fully tested and commissioned.

At completion of commissioning, acceptance certificate as per SPG 0711 is to be completed.

Appendix A Typical System Documentation

Insert tick (✓) in applicable boxes.

DATA ITEM NO.	DESCRIPTION	PRELIMINARY COPY	DESIGN COPIES	AS-BUILT COPIES
	GENERAL			
1	Completed Specification Data Sheets	1	2	2
2	Performance Curves Data	1	2	2
3	General Arrangement Outline Dimension	1	2	2
4	Routine/Type Test Certificates			
5	Manufacturing & Delivery Schedule	1		
6	Technical Literature & Brochures	1	2	2
7	Priced Spare Parts for 1 yrs Operation	1		
8	Installation & Rigging Diagrams			
9	Design Calculations & Criteria		2	2
10	Bills of Materials			
11	Name Plate Details			2
12	Complete Parts List			2
13	Installation Instructions			2
14	Operating Instructions			2
15	Maintenance Instructions			2
16	Lubrication Schedules			2
17	Certified Dimensions			2
18				
19	CIVIL			
20	Foundation & Support Plan & Loads	1	2	2
21				
22	MECHANICAL			
23	General Assembly & Cross Section Drawings	1	2	2
24	Shop Fabrication Details			
25	Drive Assembly Details			
26	Equipment Assembly Details		2	2
27	Mechanical Flow Diagrams			
28	Inlet / Outlet Details			
29	Mechanical Completion/Test Certificate[4]			2
30	Location of Services Connections			
31	Piping Schematic		2	2
32				
33	QUALITY MANAGEMENT			
34	Materials Specification	1	2	2
35	Completed QA Compliance Matrix			
36	Quality Manual	1		
37	2nd/3rd Party Accreditation			
38	Inspection & Test Plans	1	2	2
39	Performance Test Certificates & Data[4]			2
40	Hydrostatic Test Certificates & Data[4]			2
41	NDT Test Certificates & Data[4]			2
42	Material Test Certificates[4]			
43	Statutory Code Certificates			2
44	Welding Procedures		2	2

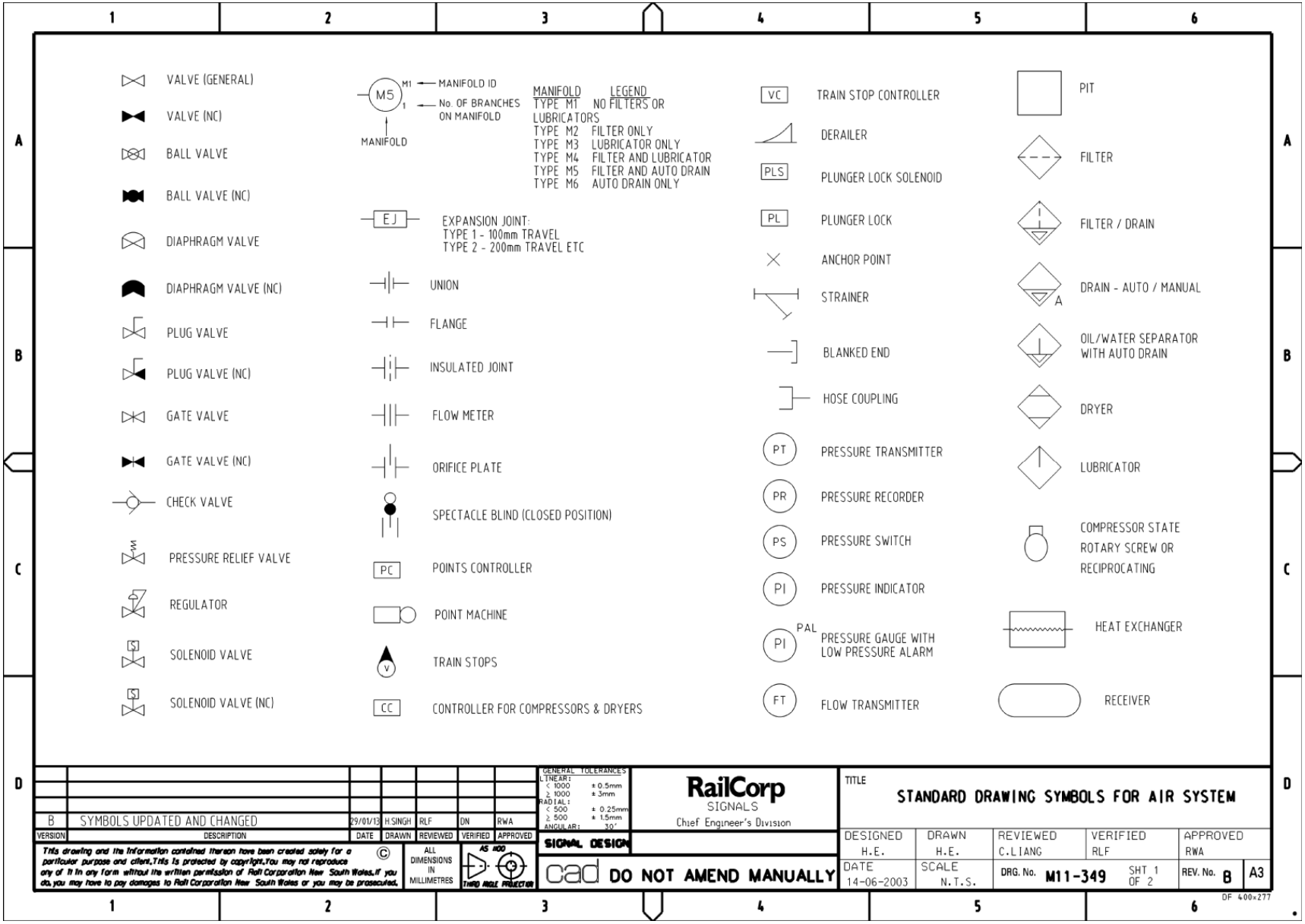
DATA ITEM NO.	DESCRIPTION	PRELIMINARY COPY	DESIGN COPIES	AS-BUILT COPIES
45	Welders Qualification Certificates[4]			
46	Welding Maps/Records			
47				
1	REVIEW CODE LEGEND: F: REVIEW REQUIRED PRIOR TO FABRICATION. S: REVIEW REQUIRED PRIOR TO SHIPMENT. I: REQUIRED FOR INFORMATION ONLY.			
2	REVIEW COPIES TO BE PROVIDED WITHIN THE TIME SHOWN (EXPRESSED AS TIME AFTER AWARD).			
3	AS-BUILT COPIES SHALL BE PROVIDED BEFORE EQUIPMENT DELIVERY. AS-BUILT DRAWINGS SHALL INCLUDE ONE FULL SIZE WITH THE REMAINDER A3 COPIES UNO.			
4	CERTIFICATES AND PERFORMANCE DATA SHALL BE PROVIDED ON COMPLETION OF TESTS.			

Table 2 - Installer Supplied Data

Appendix B Drawings

The attached technical drawing sheets form part of this document.

M11-349-1 & 2	Standard Drawing Symbols for Air System
M11-351-1 & 2	Compressed Air Piping Details
M11-350	Connection Single Trainstop to Main
M11-352	Anchor Points
M11-353	Steel Air Main Brackets
M11-355	Label Holder Installation, Part: Carrington Tang Clamp, 1/2” and 3/4”
M11-354	Label Holder Installation Example on General Manifold Arrangement
M11-307	Air Hose, P.V.C. Detail of Fittings (13 & 20 BSP)
M11-321	40 & 50 BSP Air Hose Fittings Details
M11-701	General Arrangement Compressor Room (Main Manifold)



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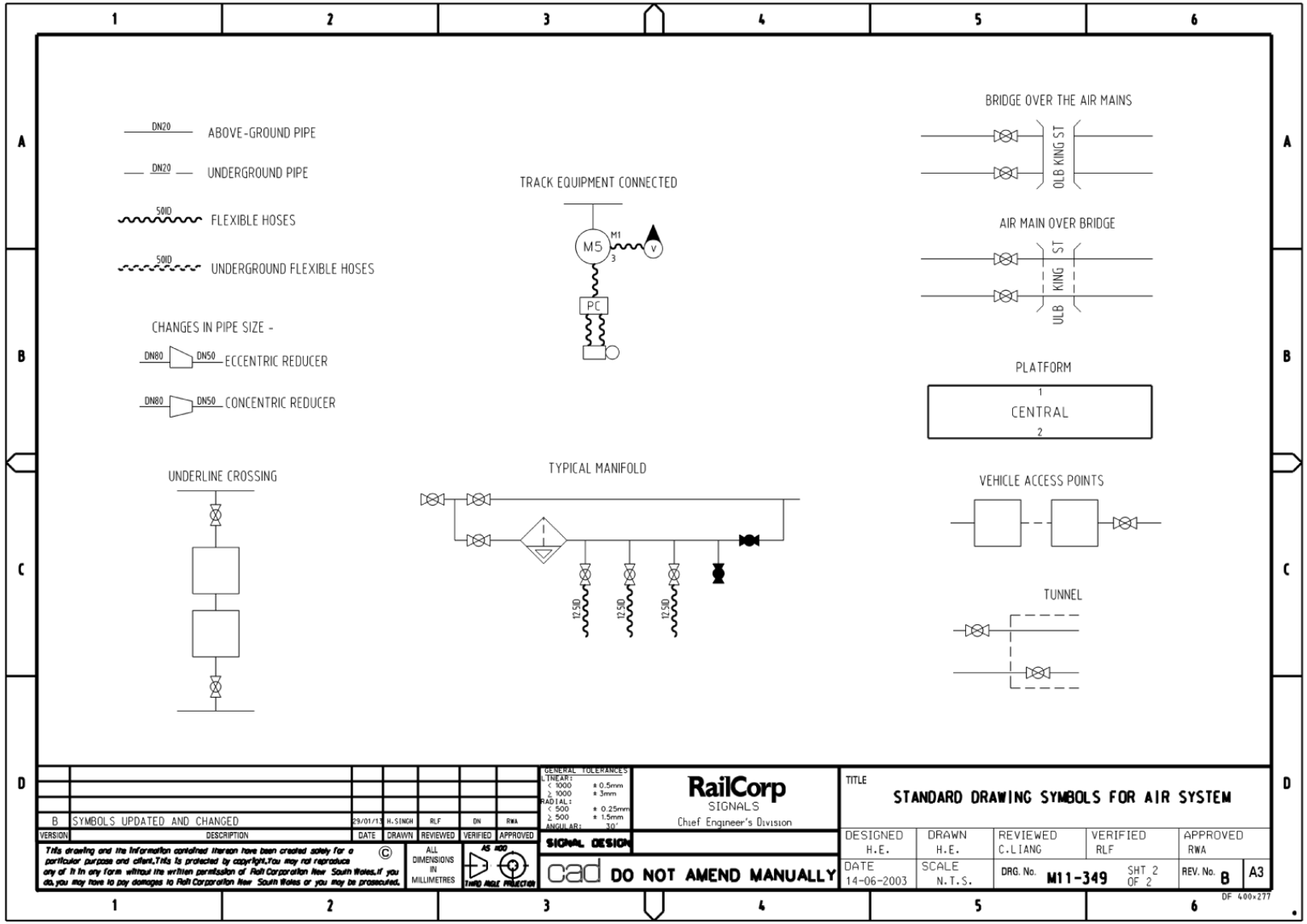
DN20 ABOVE-GROUND PIPE
DN20 UNDERGROUND PIPE
50ID FLEXIBLE HOSES
50ID UNDERGROUND FLEXIBLE HOSES
CHANGES IN PIPE SIZE -
DN80 DN50 ECCENTRIC REDUCER
DN80 DN50 CONCENTRIC REDUCER
UNDERLINE CROSSING
TRACK EQUIPMENT CONNECTED
M5
M1
3
PC
TYPICAL MANIFOLD
12.5Ø
12.5Ø
12.5Ø
BRIDGE OVER THE AIR MAINS
OLB KING ST
AIR MAIN OVER BRIDGE
ULB KING ST
PLATFORM
1
CENTRAL
2
VEHICLE ACCESS POINTS
TUNNEL
B SYMBOLS UPDATED AND CHANGED 29/01/13 H.SINGH RLF DN RWA
VERSION DESCRIPTION DATE DRAWN REVIEWED VERIFIED APPROVED
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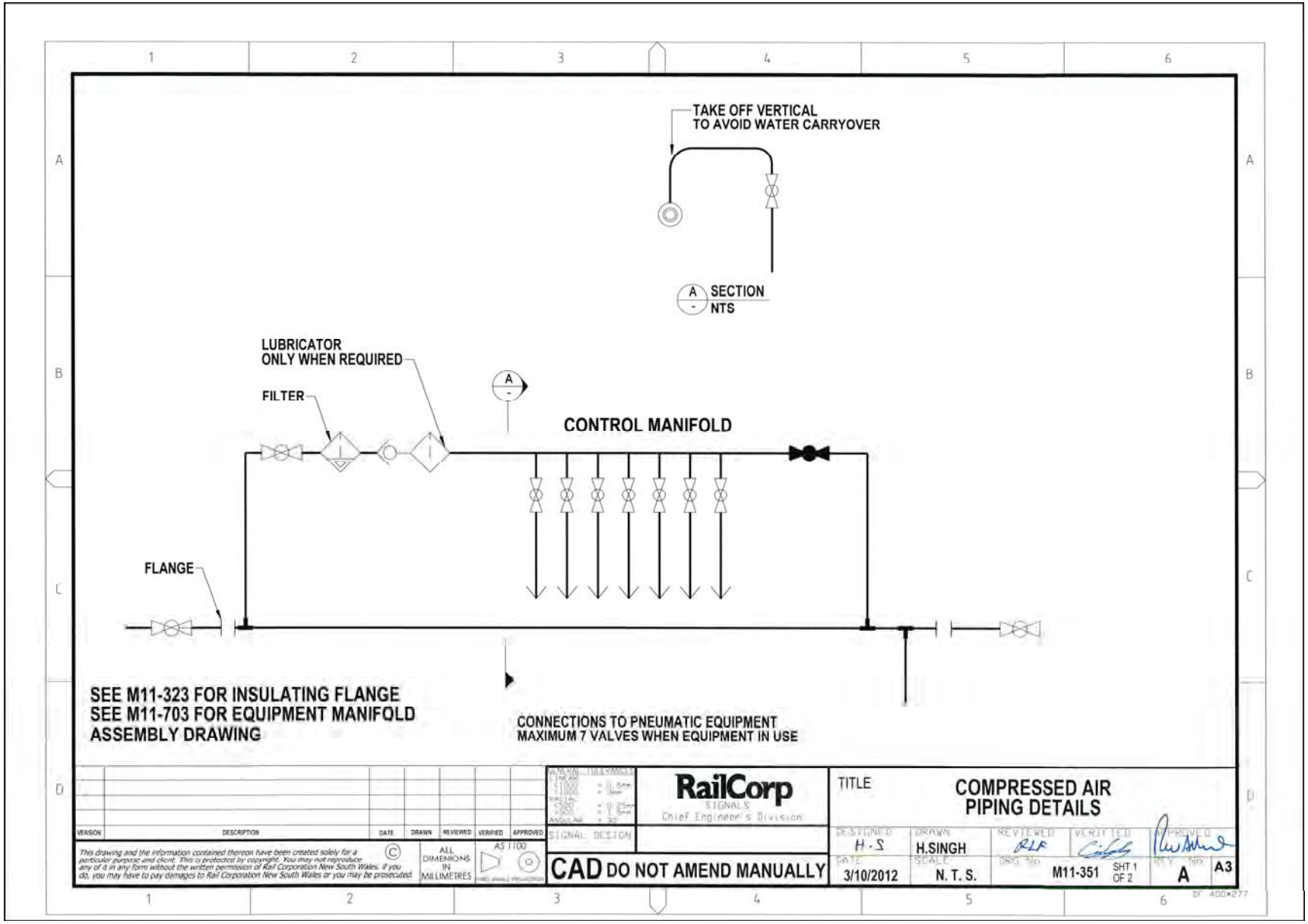
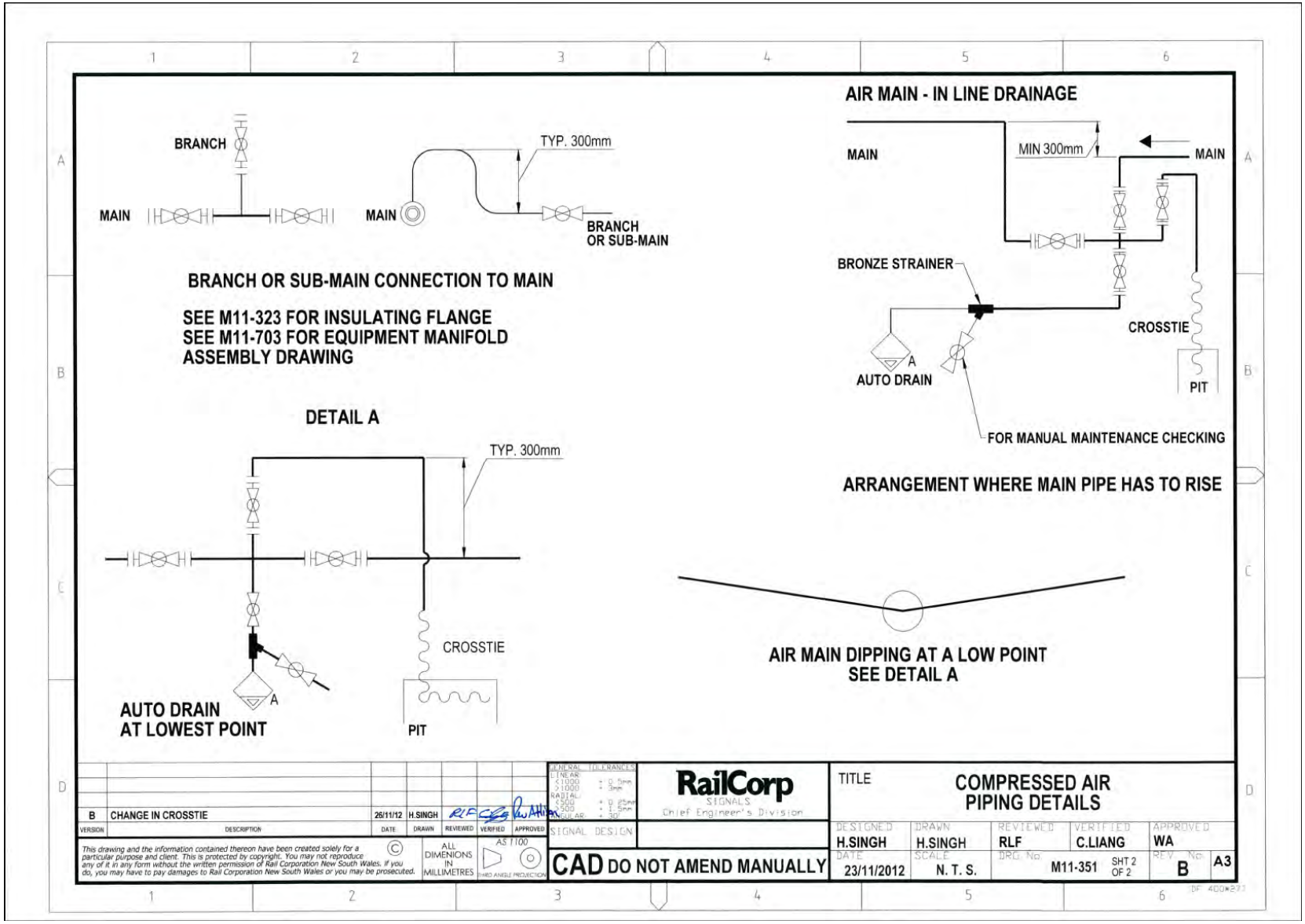
©
ALL DIMENSIONS IN MILLIMETRES
AS 400
THIRD ANGLE PROJECTION
GENERAL TOLERANCES
LINEAR:
< 1000 ± 0.5mm
≥ 1000 ± 3mm
RADIAL:
< 500 ± 0.25mm
≥ 500 ± 1.5mm
ANGULAR: 30'
SIGNAL DESIGN
cad DO NOT AMEND MANUALLY
RailCorp
SIGNALS
Chief Engineer's Division
TITLE
STANDARD DRAWING SYMBOLS FOR AIR SYSTEM
DESIGNED H.E.
DRAWN H.E.
REVIEWED C.LIANG
VERIFIED RLF
APPROVED RWA
DATE 14-06-2003
SCALE N.T.S.
DRG. No. M11-349
SHT 2 OF 2
REV. No. B
A3
DF 400x277


TAKE OFF VERTICAL
TO AVOID WATER CARRYOVER
A
SECTION
NTS
LUBRICATOR
ONLY WHEN REQUIRED
FILTER
CONTROL MANIFOLD
FLANGE
SEE M11-323 FOR INSULATING FLANGE
SEE M11-703 FOR EQUIPMENT MANIFOLD
ASSEMBLY DRAWING
CONNECTIONS TO PNEUMATIC EQUIPMENT
MAXIMUM 7 VALVES WHEN EQUIPMENT IN USE
RailCorp
SIGNALS
Chief Engineer's Division
TITLE
COMPRESSED AIR
PIPING DETAILS
DESIGNED H.S
DRAWN H.SINGH
DATE 3/10/2012
SCALE N. T. S.
M11-351
SHT 1 OF 2
A
A3
CAD DO NOT AMEND MANUALLY
ALL DIMENSIONS IN MILLIMETRES
AS 1100


BRANCH
MAIN
MAIN
TYP. 300mm
BRANCH
OR SUB-MAIN
BRANCH OR SUB-MAIN CONNECTION TO MAIN
SEE M11-323 FOR INSULATING FLANGE
SEE M11-703 FOR EQUIPMENT MANIFOLD
ASSEMBLY DRAWING
DETAIL A
TYP. 300mm
CROSSTIE
A
AUTO DRAIN
AT LOWEST POINT
PIT
AIR MAIN - IN LINE DRAINAGE
MAIN
MIN 300mm
MAIN
BRONZE STRAINER
CROSSTIE
A
AUTO DRAIN
PIT
FOR MANUAL MAINTENANCE CHECKING
ARRANGEMENT WHERE MAIN PIPE HAS TO RISE
AIR MAIN DIPPING AT A LOW POINT
SEE DETAIL A
B
CHANGE IN CROSSTIE
26/11/12
H.SINGH
RLF
VERSION
DESCRIPTION
DATE
DRAWN
REVIEWED
VERIFIED
APPROVED
GENERAL TOLERANCES
LINEAR:
< 1000 ± 0.5mm
> 1000 ± 3mm
RADIAL:
< 500 ± 0.25mm
> 500 ± 1.5mm
ANGULAR: ± 30'
SIGNAL DESIGN
RailCorp
SIGNALS
Chief Engineer's Division
TITLE
COMPRESSED AIR
PIPING DETAILS
DESIGNED
H.SINGH
DRAWN
H.SINGH
REVIEWED
RLF
VERIFIED
C.LIANG
APPROVED
WA
DATE
23/11/2012
SCALE
N. T. S.
DRG. No.
M11-351
SHT 2
OF 2
REV. No.
B
A3
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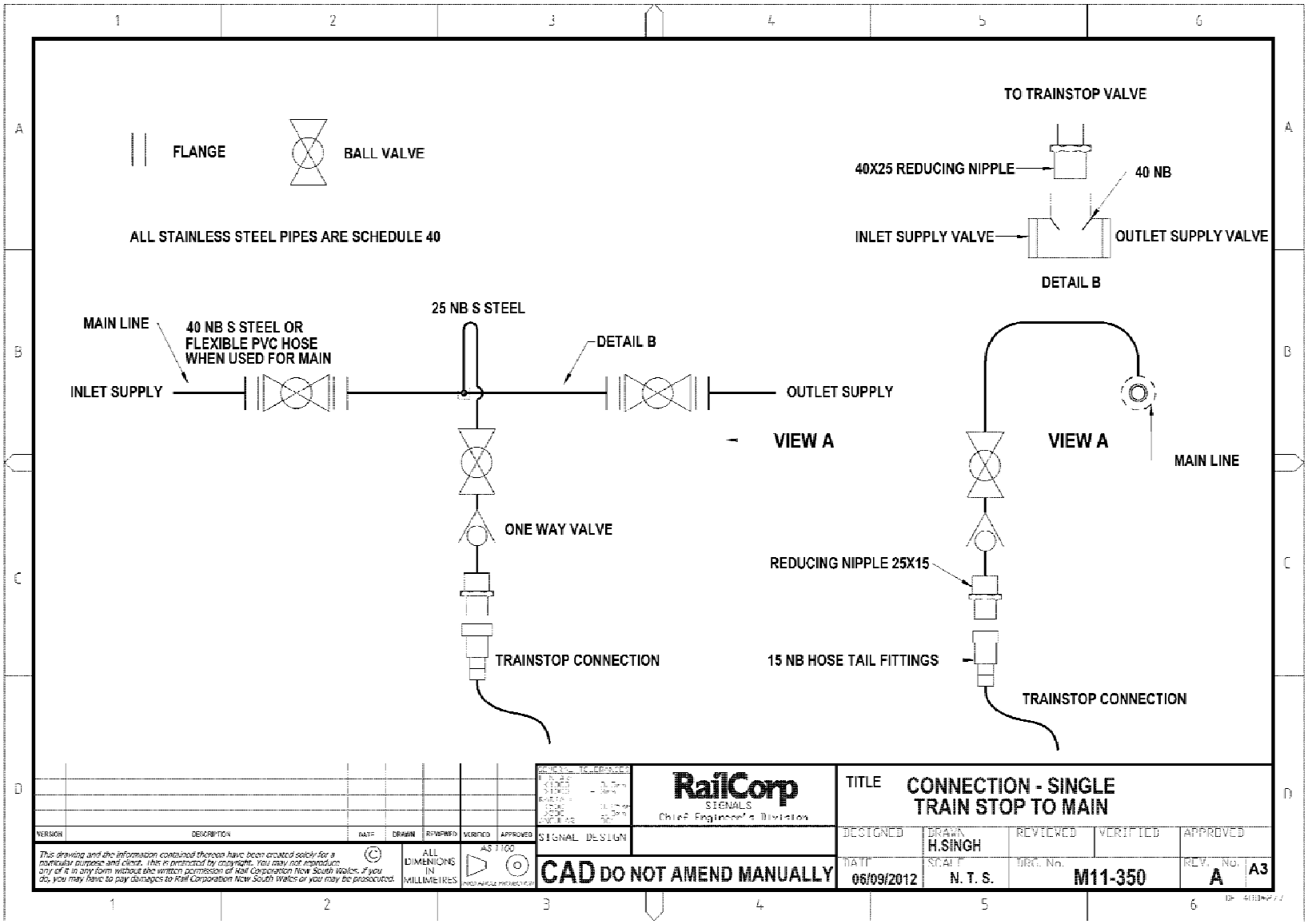
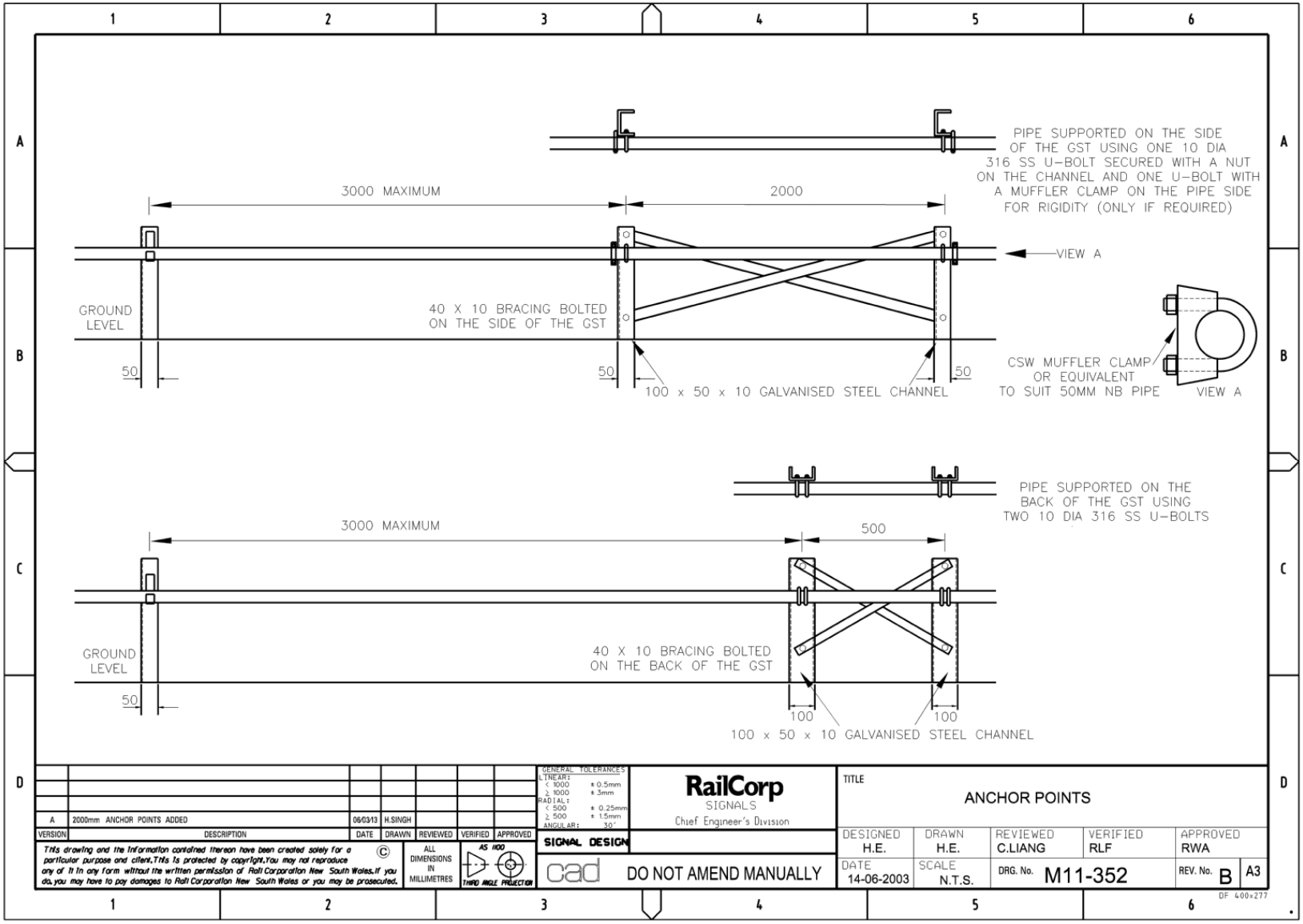
ALL DIMENIONS IN MILLIMETRES
AS 1100
THIRD ANGLE PROJECTION
CAD DO NOT AMEND MANUALLY


FLANGE
BALL VALVE
ALL STAINLESS STEEL PIPES ARE SCHEDULE 40
TO TRAINSTOP VALVE
40X25 REDUCING NIPPLE
40 NB
INLET SUPPLY VALVE
OUTLET SUPPLY VALVE
DETAIL B
MAIN LINE
40 NB S STEEL OR
FLEXIBLE PVC HOSE
WHEN USED FOR MAIN
INLET SUPPLY
25 NB S STEEL
DETAIL B
OUTLET SUPPLY
VIEW A
ONE WAY VALVE
TRAINSTOP CONNECTION
VIEW A
MAIN LINE
REDUCING NIPPLE 25X15
15 NB HOSE TAIL FITTINGS
TRAINSTOP CONNECTION
RailCorp
SIGNALS
Chief Engineer's Division
SIGNAL DESIGN
TITLE
CONNECTION - SINGLE
TRAIN STOP TO MAIN
DESIGNED
DRAWN
H.SINGH
REVIEWED
VERIFIED
APPROVED
DATE
06/09/2012
SCALE
N. T. S.
DRG. No.
M11-350
REV. No.
A
A3
CAD DO NOT AMEND MANUALLY
ALL DIMENSIONS IN MILLIMETRES
AS 1100


PIPE SUPPORTED ON THE SIDE OF THE GST USING ONE 10 DIA 316 SS U-BOLT SECURED WITH A NUT ON THE CHANNEL AND ONE U-BOLT WITH A MUFFLER CLAMP ON THE PIPE SIDE FOR RIGIDITY (ONLY IF REQUIRED)
3000 MAXIMUM
2000
VIEW A
GROUND LEVEL
40 X 10 BRACING BOLTED ON THE SIDE OF THE GST
50
50
50
100 x 50 x 10 GALVANISED STEEL CHANNEL
CSW MUFFLER CLAMP OR EQUIVALENT TO SUIT 50MM NB PIPE
VIEW A
PIPE SUPPORTED ON THE BACK OF THE GST USING TWO 10 DIA 316 SS U-BOLTS
3000 MAXIMUM
500
GROUND LEVEL
40 X 10 BRACING BOLTED ON THE BACK OF THE GST
50
100
100
100 x 50 x 10 GALVANISED STEEL CHANNEL
A 2000mm ANCHOR POINTS ADDED 06/03/13 H.SINGH
VERSION DESCRIPTION DATE DRAWN REVIEWED VERIFIED APPROVED
GENERAL TOLERANCES
LINEAR: < 1000 ± 0.5mm ≥ 1000 ± 3mm
RADIAL: < 500 ± 0.25mm ≥ 500 ± 1.5mm
ANGULAR: 30'
RailCorp
SIGNALS
Chief Engineer's Division
SIGNAL DESIGN
cad
DO NOT AMEND MANUALLY
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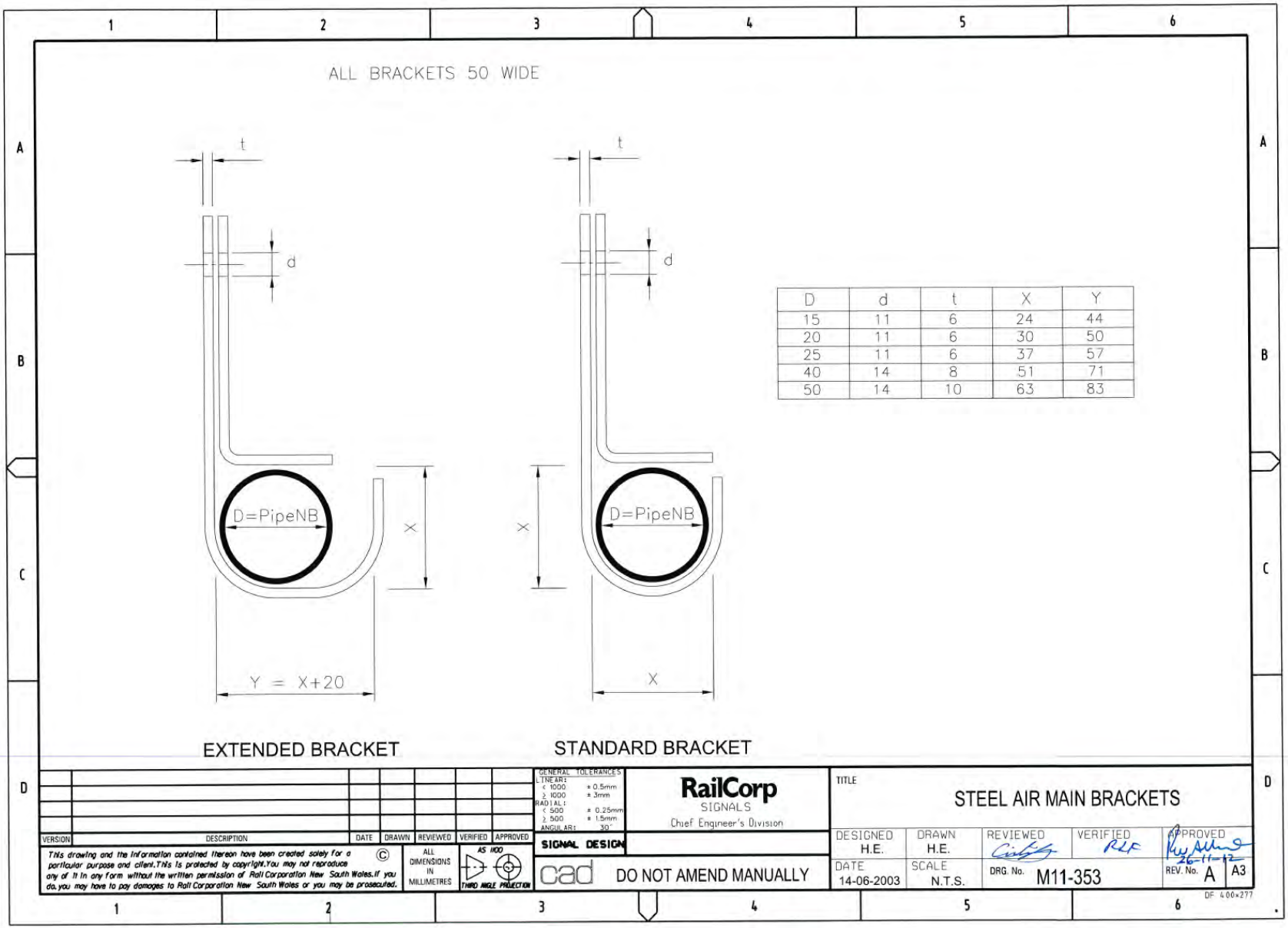
ALL DIMENSIONS IN MILLIMETRES
AS 1100
THIRD ANGLE PROJECTION
TITLE
ANCHOR POINTS
DESIGNED H.E.
DRAWN H.E.
REVIEWED C.LIANG
VERIFIED RLF
APPROVED RWA
DATE 14-06-2003
SCALE N.T.S.
DRG. No. M11-352
REV. No. B
A3
DF 400x277
$USERNAME$$$$$$$$SYTIME$$$$$$$$$$$$$$$$$$$$DGN$SPECIFICATION$$$$$$$$$$$$



D	d	t	X	Y
15	11	6	24	44
20	11	6	30	50
25	11	6	37	57
40	14	8	51	71
50	14	10	63	83

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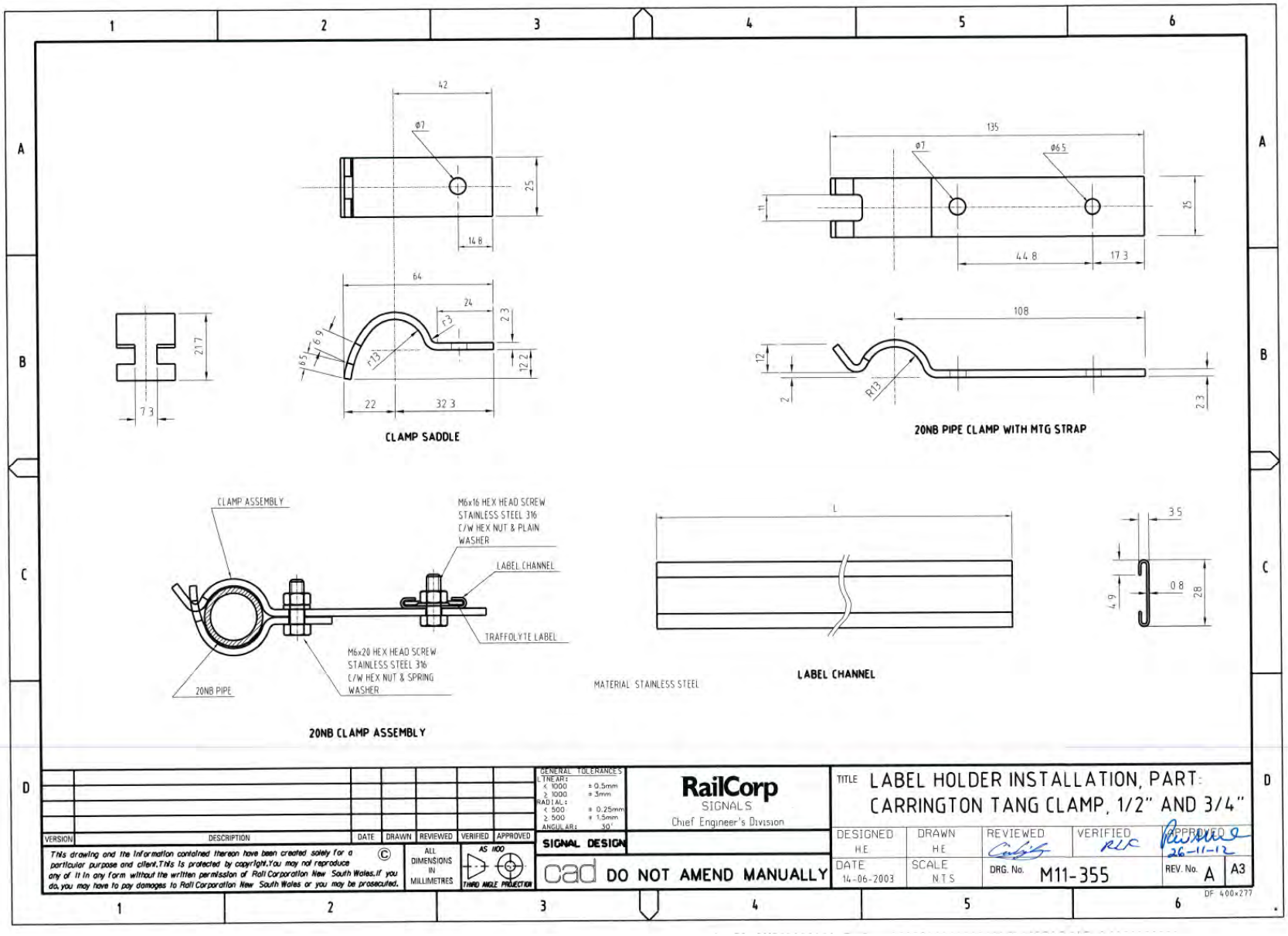
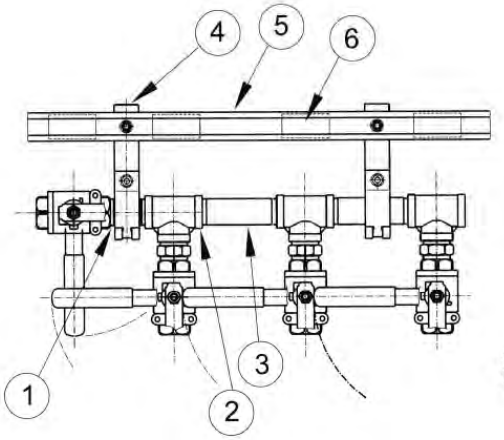

CLAMP SADDLE
20NB PIPE CLAMP WITH MTG STRAP
CLAMP ASSEMBLY
M6x16 HEX HEAD SCREW STAINLESS STEEL 316 C/W HEX NUT & PLAIN WASHER
LABEL CHANNEL
TRAFFOLYTE LABEL
M6x20 HEX HEAD SCREW STAINLESS STEEL 316 C/W HEX NUT & SPRING WASHER
20NB PIPE
20NB CLAMP ASSEMBLY
MATERIAL STAINLESS STEEL
LABEL CHANNEL
RailCorp
SIGNALS
Chief Engineer's Division
SIGNAL DESIGN
cad DO NOT AMEND MANUALLY
TITLE LABEL HOLDER INSTALLATION, PART: CARRINGTON TANG CLAMP, 1/2" AND 3/4"
DESIGNED H.E.
DRAWN H.E.
REVIEWED
VERIFIED RLC
APPROVED 26-11-12
DATE 14-06-2003
SCALE N.T.S
DRG. No. M11-355
REV. No. A
A3
DF 400x277



REFER
DRAWING M11-355

MATERIAL LIST

ITEM	DESCRIPTION	MATERIAL	SUPPLIER / PART No	QTY
1	20mm NB BARRELL NIPPLE BSP ~60mm LONG	ST STEEL 316	CARRINGTON	4
2	20 NB TEE BSP	ST STEEL 316	CARRINGTON	2
3	20mm NB BARRELL NIPPLE BSP ~100mm LONG	ST STEEL 316	CARRINGTON	3
4	20mm NB LABEL CLAMP ASSEMBLY	ST STEEL 316	CARRINGTON	2
5	LABEL CHANNEL (LENGTH A/R)	ST STEEL 316	CARRINGTON	1
6	TRAFFOLYTE LABEL TO SUIT	TRAFFOLYTE	WHITE ON BLACK	A/R

VERSION	DESCRIPTION	DATE	DRAWN	REVIEWED	VERIFIED	APPROVED

GENERAL TOLERANCES
LINEAR:
< 1000 ± 0.5mm
≥ 1000 ± 3mm
RADIAL:
< 500 ± 0.25mm
≥ 500 ± 1.5mm
ANGULAR: 30'

RailCorp
SIGNALS
Chief Engineer's Division

SIGNAL DESIGN

cad DO NOT AMEND MANUALLY

TITLE LABEL HOLDER INSTALLATION EXAMPLE ON GENERAL MANIFOLD ARRANGEMENT

DESIGNED	DRAWN	REVIEWED	VERIFIED	APPROVED
H.E.	H.E.		RLF	26-11-13
DATE 14-06-2003	SCALE N.T.S.	DRG. No. M11-354	REV. No. A	A3

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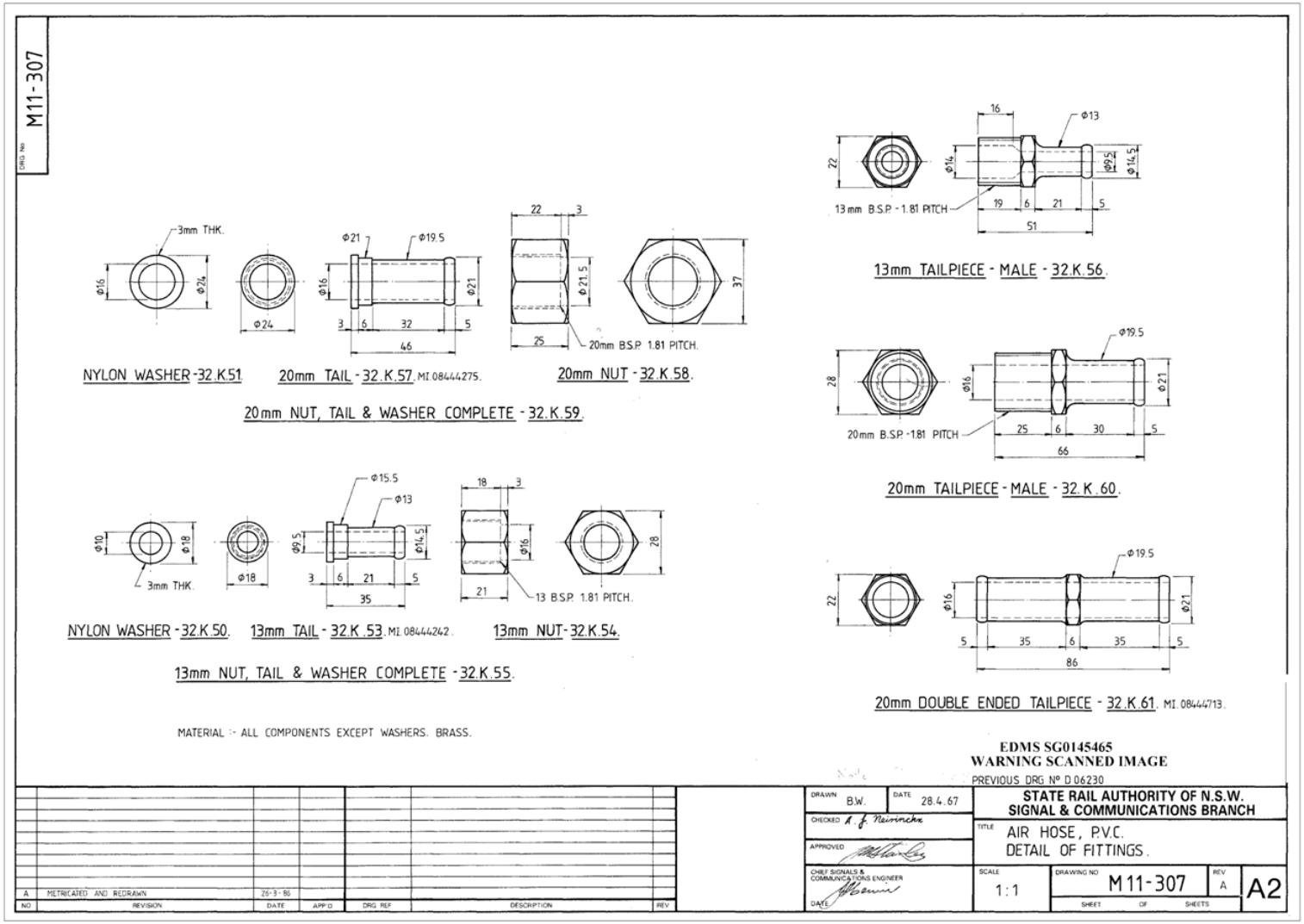
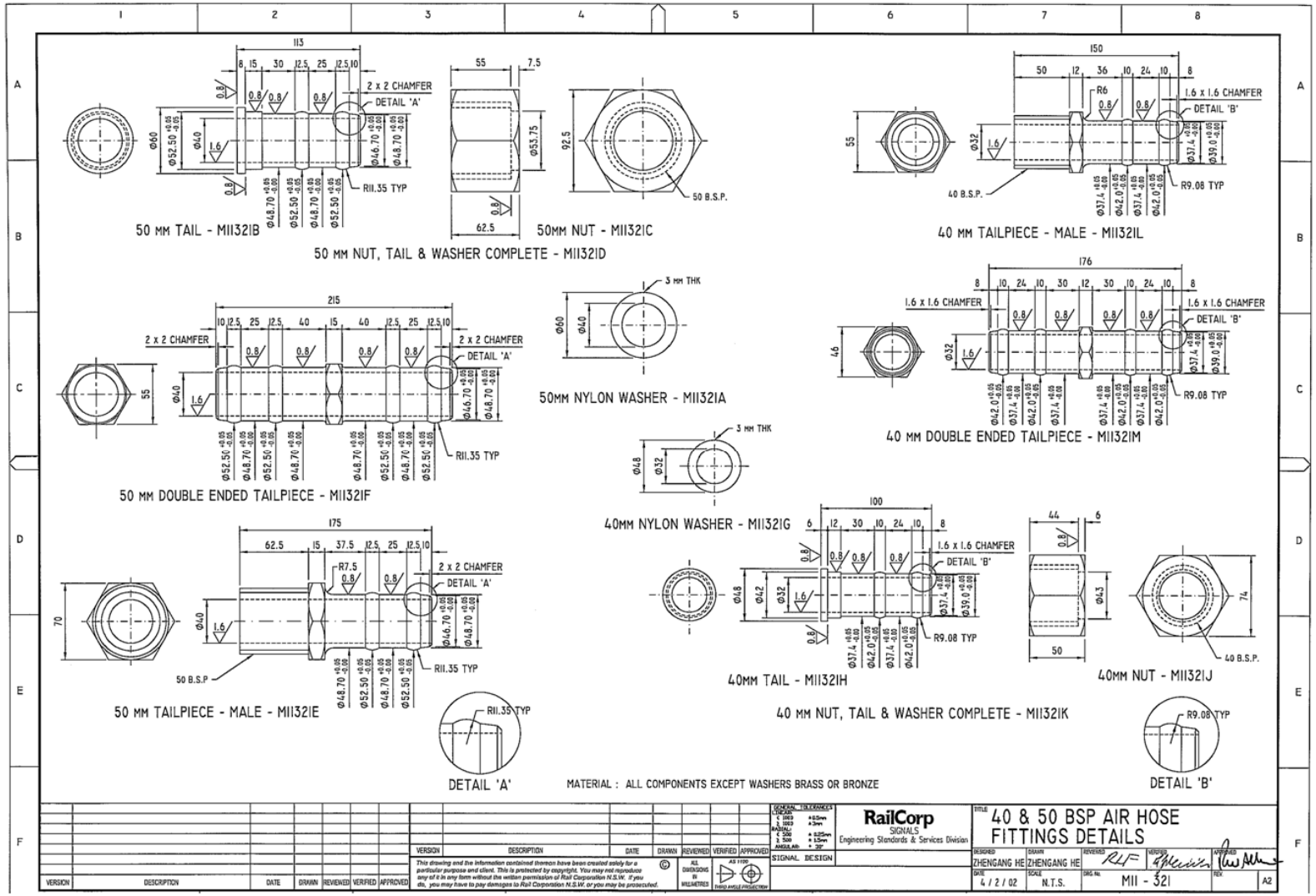
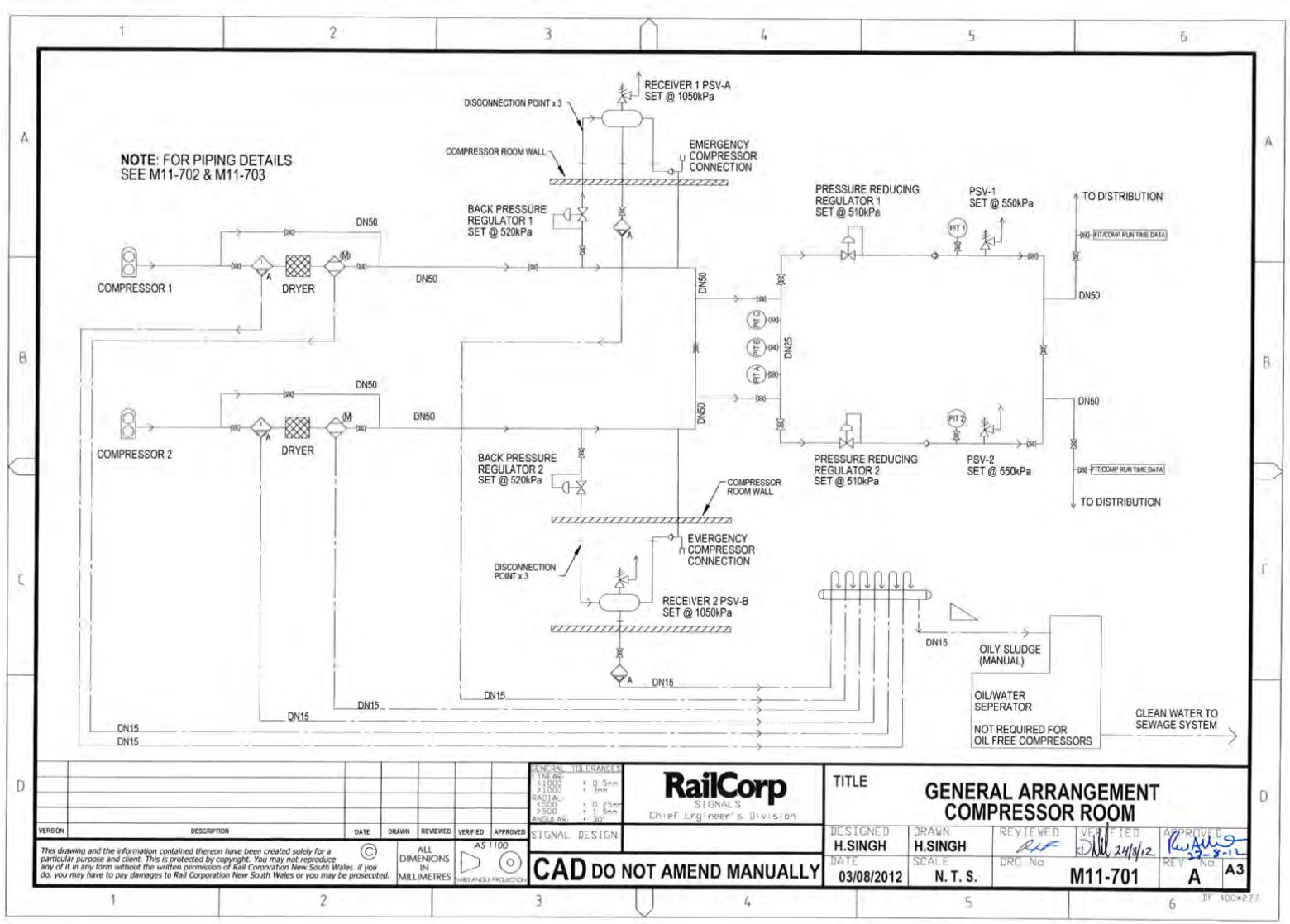
ALL DIMENSIONS IN MILLIMETRES

AS 1100 THIRD ANGLE PROJECTION

DF 400x277


DRG NO M11-307
3mm THK.
NYLON WASHER - 32.K.51
20mm TAIL - 32.K.57. MI 08444275.
20mm NUT - 32.K.58.
20mm NUT, TAIL & WASHER COMPLETE - 32.K.59.
20mm B.S.P. 1.81 PITCH.
NYLON WASHER - 32.K.50.
13mm TAIL - 32.K.53. MI 08444242.
13mm NUT - 32.K.54.
13mm NUT, TAIL & WASHER COMPLETE - 32.K.55.
13 B.S.P. 1.81 PITCH.
MATERIAL :- ALL COMPONENTS EXCEPT WASHERS. BRASS.
13mm TAILPIECE - MALE - 32.K.56.
13 mm B.S.P. - 1.81 PITCH
20mm TAILPIECE - MALE - 32.K.60.
20mm B.S.P. - 1.81 PITCH
20mm DOUBLE ENDED TAILPIECE - 32.K.61. MI. 08444713.
EDMS SG0145465
WARNING SCANNED IMAGE
PREVIOUS DRG Nº D 06230
A METRICATED AND REDRAWN 26-3-86
DRAWN B.W. DATE 28.4.67
CHECKED
APPROVED
CHIEF SIGNALS & COMMUNICATIONS ENGINEER
DATE
STATE RAIL AUTHORITY OF N.S.W.
SIGNAL & COMMUNICATIONS BRANCH
TITLE AIR HOSE, P.V.C.
DETAIL OF FITTINGS.
SCALE 1:1
DRAWING NO M11-307
REV A
A2
SHEET OF SHEETS


50 MM TAIL - MII321B
50MM NUT - MII321C
50 MM NUT, TAIL & WASHER COMPLETE - MII321D
40 MM TAILPIECE - MALE - MII321L
50MM NYLON WASHER - MII321A
40 MM DOUBLE ENDED TAILPIECE - MII321M
50 MM DOUBLE ENDED TAILPIECE - MII321F
40MM NYLON WASHER - MII321G
50 MM TAILPIECE - MALE - MII321E
40MM TAIL - MII321H
40MM NUT - MII321J
40 MM NUT, TAIL & WASHER COMPLETE - MII321K
DETAIL 'A'
DETAIL 'B'
MATERIAL : ALL COMPONENTS EXCEPT WASHERS BRASS OR BRONZE
RailCorp
SIGNALS
Engineering Standards & Services Division
40 & 50 BSP AIR HOSE FITTINGS DETAILS
ZHENGANG HE
4 / 2 / 02
N.T.S.
MII - 321
A2


NOTE: FOR PIPING DETAILS
SEE M11-702 & M11-703
RECEIVER 1 PSV-A
SET @ 1050kPa
DISCONNECTION POINT x 3
COMPRESSOR ROOM WALL
EMERGENCY
COMPRESSOR
CONNECTION
BACK PRESSURE
REGULATOR 1
SET @ 520kPa
PRESSURE REDUCING
REGULATOR 1
SET @ 510kPa
PSV-1
SET @ 550kPa
TO DISTRIBUTION
COMPRESSOR 1
DRYER
DN50
DN25
COMPRESSOR 2
DRYER
BACK PRESSURE
REGULATOR 2
SET @ 520kPa
PRESSURE REDUCING
REGULATOR 2
SET @ 510kPa
PSV-2
SET @ 550kPa
COMPRESSOR
ROOM WALL
EMERGENCY
COMPRESSOR
CONNECTION
DISCONNECTION
POINT x 3
RECEIVER 2 PSV-B
SET @ 1050kPa
DN15
OILY SLUDGE
(MANUAL)
OIL/WATER
SEPERATOR
NOT REQUIRED FOR
OIL FREE COMPRESSORS
CLEAN WATER TO
SEWAGE SYSTEM
RailCorp
SIGNALS
Chief Engineer's Division
TITLE
GENERAL ARRANGEMENT
COMPRESSOR ROOM
DESIGNED H.SINGH
DRAWN H.SINGH
REVIEWED
VERIFIED
APPROVED
DATE 03/08/2012
SCALE N. T. S.
DRG No M11-701
REV No A
A3
CAD DO NOT AMEND MANUALLY
SIGNAL DESIGN
ALL DIMENIONS IN MILLIMETRES
AS 1100
THIRD ANGLE PROJECTION
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Appendix C Data Sheets

The attached data sheets form part of this document.

DS-P-001 GMS01 Piping

DS-P-002 MS01 Piping

DS-P-003 SS01 Piping

RailCorp	DATA SHEET	Data Sheet Number:	DS-P-001
		Sheet	1 of 1

GMS01 Piping

General	
Description	Above ground carbon steel piping, air service and condensate
Design code	AS 4041 class 3
Design pressure (kPa)	800
Design temperature (°C at max press)	50
Test pressure (kPa)	1000
Fluids	Compressed Air
Size (mm)	DN 15 to DN 150
Design life (years)	50
Corrosion allowance (mm)	1.5
Fluid	
Description	Air at pressure, to ISO 8573 class 4
Solids	Maximum 1000 particles per m^3, of size 1 to 5 micron
Moisture	Dewpoint 3 °C
Oil	Maximum 5 mg/m^3
Materials	
Pipe, DN 15 to DN 50	AS 1074, medium, galvanised, threaded ends
Pipe, DN 65 to DN 150	AS 1074, medium, black, plain ends (note 2)
Joints, DN 15 to DN 50	Screwed
Joints, DN 65 to DN 150	Welded or flanged
Flanges	AS 2129 Table E, slip on, raised face
Fittings, DN 15 to DN 50	BS EN 10241, screwed BSP, galvanised
Fittings, DN 65 to DN 150	ASTM A234 WPB, std wt, seamless, butt welded
Gaskets	Compressed fibre, non-asbestos, 1.5 mm
Thread sealant	PTFE tape
Bolting	AS 2528
Valves, DN 15 to DN 50	Ball valve, 316 SS body and ball, glass reinforced PTFE seat, screwed BSP, lever operated, lockable
Valves, DN 65 to DN 150	Ball valve, 316 SS body and ball, glass reinforced PTFE seat, flanged Table E, lever operated, lockable
Flexible hose, DN 20 to DN 80	AS 2554 Class B PVC (excluding tunnels); AS 2660 Class B PVC (tunnels)
Accessories	
Supports, guides	Saddle or U-bolt
Supports, anchors	Double saddle to rigid surface
Vents	DN 20 ball valve at high point
Drains	DN 25 ball valve at low point, with auto drain

Notes:

1	Items marked # to be determined during design phase.
2	Welded pipe spools to be hot dipped galvanised after fabrication.

RailCorp	DATA SHEET	Data Sheet Number:	DS-P-002
		Sheet	1 of 1

MS01 Piping

General	
Description	Below ground carbon steel piping, air service
Design code	AS 4041 class 3
Design pressure (kPa)	800
Design temperature (^{0}C at max press)	50
Test pressure (kPa)	1000
Fluids	Compressed Air
Size (mm)	DN 15 to DN 150
Design life (years)	50
Corrosion allowance (mm)	1.5
Fluid	
Description	Air at pressure, to ISO 8573 class 4
Solids	Maximum 1000 particles per m^3, of size 1 to 5 micron
Moisture	Dewpoint 3 ^{0}C
Oil	Maximum 5 mg/m^3
Materials	
Pipe, DN 15 to DN 50	AS 1074, medium, polyethylene coated, plain ends
Pipe, DN 65 to DN 150	AS 1074, medium, polyethylene coated, plain ends
Joints, DN 15 to DN 50	Welded, with shrink wrap overlay; or flanged (note 2)
Joints, DN 65 to DN 150	Welded, with shrink wrap overlay; or flanged (note 2)
Flanges	AS 2129 Table E, slip on, raised face
Fittings, DN 15 to DN 50	ASTM A234 WPB, std wt, seamless, butt welded
Fittings, DN 65 to DN 150	ASTM A234 WPB, std wt, seamless, butt welded
Gaskets	Compressed fibre, non-asbestos, 1.5 mm
Bolting	AS 2528
Valves, DN 15 to DN 50	Ball valve, 316 SS body and ball, glass reinforced PTFE seat, flanged Table E, lever operated,
Valves, DN 65 to DN 150	Ball valve, 316 SS body and ball, glass reinforced PTFE seat, flanged Table E, lever operated, lockable
Flexible hose, DN 20 to DN 80	AS 2554 Class B, PVC outer
Accessories	
Supports, guides	Saddle or U-bolt
Supports, anchors	Double saddle to rigid surface
Vents	DN 20 ball valve at high point
Drains	DN 25 ball valve at low point, with auto drain

Notes:

1	Items marked # to be determined during design phase
2	Valves and flanged joints at pits only, not buried.

RailCorp	DATA SHEET	Data Sheet Number:	DS-P-003
		Sheet	1 of 1

SS01 Piping

General	
Description	Above ground stainless steel piping, air service
Design code	AS 4041 class 3
Design pressure (kPa)	800
Design temperature (°C at max press)	50
Test pressure (kPa)	1000
Fluids	Compressed Air
Size (mm)	DN 15 to DN 150
Design life (years)	50
Corrosion allowance (mm)	0.5
Fluid	
Description	Air at pressure, to ISO 8573 class 4
Solids	Maximum 1000 particles per m^3, of size 1 to 5 micron
Moisture	Dewpoint 3 °C
Oil	Maximum 5 mg/m^3
Materials	
Pipe, DN 15 to DN 50	ASTM 312 TP 304, sch 40s, threaded ends
Pipe, DN 65 to DN 150	ASTM 312 TP 304, sch 40s, plain ends
Joints, DN 15 to DN 50	Screwed
Joints, DN 65 to DN 150	Welded or flanged
Flanges	AS 2129 Table E, slip on, raised face, ASTM A240 TP 304L
Fittings, DN 15 to DN 50	ISO 4144, screwed BSP, 304L
Fittings, DN 65 to DN 150	ASTM A403 WP304, std wt, seamless, butt welded
Gaskets	Compressed fibre, non-asbestos, 1.5 mm
Thread sealant	PTFE tape
Bolting	AS 2528, 304 or 316
Valves, DN 15 to DN 50	Ball valve, 316 SS body and ball, glass reinforced PTFE seat, screwed BSP, lever operated, lockable
Valves, DN 65 to DN 150	Ball valve, 316 SS body and ball, glass reinforced PTFE seat, flanged Table E, lever operated, lockable
Flexible hose, DN 20 to DN 80	AS 2554 Class B, PVC outer
Stainless Steel Braided (Corrugated) Hose	ISO10380 Type1, annular corrugated metal hose, ISO 304 single braided, 316 stainless steel fittings
Accessories	
Supports, guides	Saddle or U-bolt; insulating material over pipe
Supports, anchors	Double saddle to rigid surface; 304 or 316
Vents	DN 20 ball valve at high point
Drains	DN 25 ball valve at low point, with auto drain

Notes:

1	Items marked # to be determined during design phase